

Ecole Doctorale des Sciences Fondamentales

Title of the thesis: Measurement of the Higgs Top Yukawa coupling with the ATLAS detector at LHC

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Summary :

The Standard Model, the theory that describes forces and matter, predicts the existence of the Higgs boson and six quarks, the heaviest one being the Top quark. This particle plays a significant role in the Standard Model. Its coupling to the Higgs boson is the most important one. Its value has for example a significant impact on the stability of the Electro-Weak vacuum.

The discovery of the Higgs boson in 2012 opened the road to the study of its properties. The observation of its production and of its decay into two photons provides an indirect measurement of the Top Yukawa coupling. However, such a production process and decay involve loops that can be sensitive to new physics.

The observation of the associated production of Top quark pairs with a Higgs boson (ttH) can provide an evidence for the coupling at the tree level, whose value can be compared to Standard Model predictions.

The ATLAS experiment is one of the large experiments of the LHC (Large Hadron Collider) at CERN. The increased beam energy and the high luminosity, which is delivered by the collider since 2016, will allow to perform direct measurements of the Top Yukawa coupling using ttH final state.

The PhD student is expected to have a significant contribution to ATLAS data analysis by developing different signal selections and event reconstructions using jet and leptonic final states. The use of advanced statistical methods when interpreting the results is foreseen. In addition to physics analysis, an objective of the thesis is to contribute to detector operations mainly related to the Tile Hadronic Calorimeter which plays a significant role in ATLAS measurements.

A subsidiary objective of the thesis can be the prospective study of the coupling measurement. This will be performed in the context of future colliders like FCC, a possible 100 TeV collider to be hosted by CERN, for which the physics case is developed.

The ATLAS team of LPC has a strong expertise in searches with Top quarks in the final state. The team is also involved in detector operation and developments.

The PhD student is expected to travel on a regular basis to CERN to take part to collaboration meetings or detector operations.